Iowa Farm Science

Volume 18 | Number 5 Article 8

11-1963

Why the Rapid Farm Adjustments in Southern Iowa?

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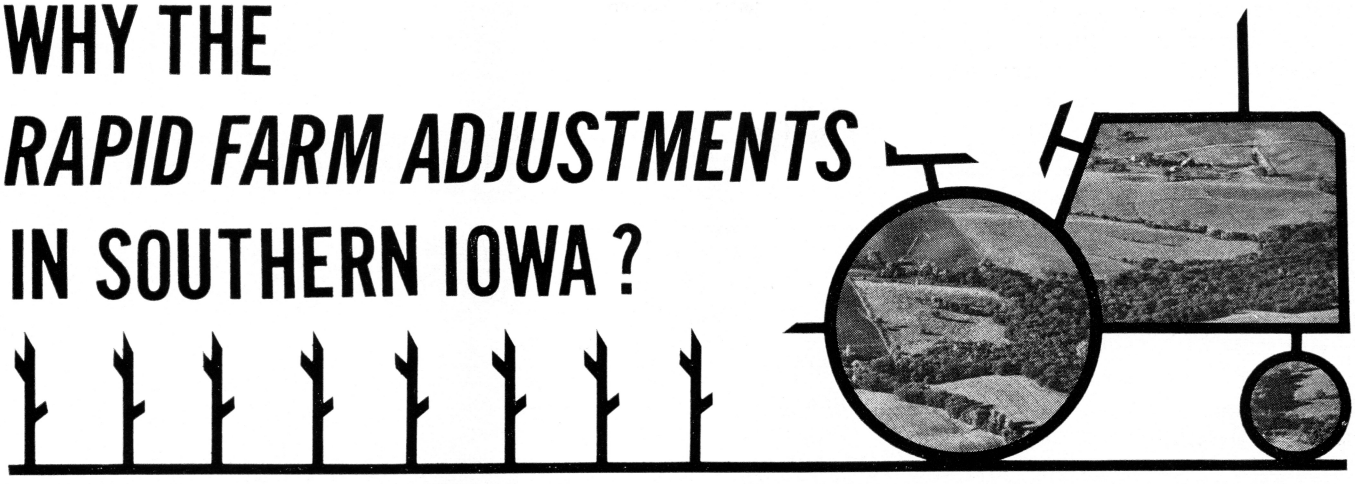
WHY THE *RAPID FARM ADJUSTMENTS* IN SOUTHERN IOWA?



by Leo V. Mayer, Earl O. Heady and Loren Ihnen

WHAT EFFECT does increased farm size have on lowering costs and increasing farm income? Some farm operators believe that their per-unit crop production costs will decline when they increase their acreage and use larger machines. If so, a farmer should be able to increase his income by farming more acres with larger machines.

To determine how different farm sizes and machine combinations might affect costs and farm incomes, we studied farms in southern Iowa. Before going into our results, here's some background information about the area.

The Area . . .

Farm consolidation and enlargement have been more rapid in south-central Iowa than in other areas of the state. From 1928 to 1961 the average acreage per farm in southern Iowa increased 39 percent, while the average for the state increased 21 percent.

Farm population, on the other hand, has declined rapidly as farm size has increased. From 1948 to 1961, the number of people on farms in southern Iowa decreased 21 percent. Despite this trend, labor still forms a larger proportion of total resources used in the area than elsewhere in Iowa.

Many farm adjustments already have taken place in south-central Iowa. But the relatively low income, the smaller volume of business per farm and the existing "resource combinations" (land or farm size, capital, labor, machinery, etc.) indicate that further adjustments will be necessary – if per-farm income is to be raised to the income levels for other areas of the state. Adjustments are difficult in this area. For example, there are few nonfarm employment opportunities. The adjustment problems in south-central Iowa aren't unique, but they're more severe than in other areas of the state.

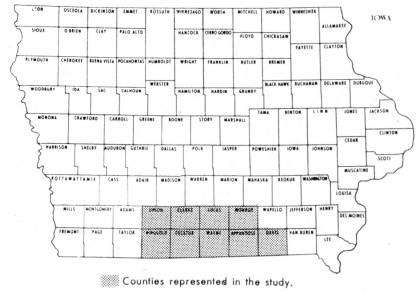
We studied the Shelby-Grundy-Haig soil area in south-central Iowa. The area includes most of Ringgold and Clarke counties and parts of Union, Decatur, Lucas and Monroe counties.

Within the soil association area, we classified three types of farms: hilly, "average" and upland. *Hilly farms* consist mainly of rolling to hilly upland, with small amounts of bottomland and level to undulating upland. *"Average" farms* consist largely of rolling upland, with small amounts of hilly and level upland. *Upland farms* are composed mostly of level to undulating upland, with lesser amounts of bottomland and rolling to hilly upland. The kinds of land included in each class of farm are classified broadly in the table.

Crop production costs for different machinery combinations and sizes used on different acreages or sizes of farms were budgeted for each of the farm groups listed. We estimated the production costs for each $1 of crop production. Costs of crop production were developed for each of five machinery combinations: one 2-plow tractor, one 3-plow tractor, two 2-plow tractors, one 2-plow tractor and one 3-plow tractor, and two 3-plow tractors (with appropriate sizes of machinery for each tractor size). The smallest cropping acreage considered was 40 acres. Our study refers to *crop acres per farm* only; total farm size would be larger.

Average Farm . . .

Chart 1 shows the costs for the five machinery combinations for the "average" farm when crop losses are considered. Crop losses are considered because yields are reduced if a given set or size of machinery is used on too many acres. Yields also decline if planting, harvesting and other operations are delayed too long. The cost curves decline at first, as fixed costs (taxes, depreciation and overhead)



Counties represented in the study.

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are spread over more acres. But they rise when so many acres are operated with given machinery that yields per acre are reduced.

If crop losses are ignored, the machinery combinations of two 2-plow tractors or of one 2-plow and one 3-plow tractor aren't the most efficient. But, if crop losses are considered, the 2-plow, 3-plow combination has the lowest average cost for 190 to 350 crop acres — equal to a total farm size of 320 to 680 acres. Losses from untimely field operations with the smaller machinery combinations are the main cause of this difference in the costs.

Cost per unit of production: Small machinery combinations are the most efficient for small acreages. For example, the one 2-plow-tractor combination is the most efficient of the five machinery combinations up to 100 crop acres per farm. But it's a high-cost combination, costing approximately $1.25 for each $1 of crop production. These costs result when operating costs, depreciation, interest on a farmer's investment and labor valued at $1.35 per hour are included. A farmer can't operate at a loss such as this for any length of time. If he doesn't charge for his own labor, doesn't deduct for depreciation on machinery or charge interest on his investment, however, he could operate for some time under this situation. And some farmers in the area probably are "coming out" like this now.

The one 2-plow combination reaches its lowest cost at 160 crop acres and rises sharply with larger acreages, but it isn't the most efficient combination for 160 acres. A farmer with 160 crop acres could reduce his costs by shifting from the one 2-plow combination to a one 3-plow combination. The 3-plow is the most efficient of the five machinery combinations from 90 to 190 crop acres. A farmer with 190 to 440 crop acres could choose a machinery combination of either one 2-plow and one 3-plow or a combination of two 3-plows without materially affecting per-unit costs. For larger crop acreages, yield losses for the 2-plow, 3-plow combination more than offset its fixed cost advantage over the 3-plow, 3-plow combination.

Though the one 2-plow or the one 3-plow combination is the most efficient for small acreages, both are high cost methods of production. The minimum per-unit cost for 80, 160 and 320 crop acres illustrates this point. The most efficient combinations for those acreages are: 80 acres, one 2-plow; 160 acres, one 3-plow; 320 acres, one 2-plow and one 3-plow. Per-unit costs for those acreages and machinery combinations are $1.35, $1.07 and 93 cents per $1 of crop production. Thus, even with the most efficient machinery combination, per-unit cost for 80 crop acres is 45 percent larger than for 320 crop acres. With 160 crop acres, per-unit cost still is larger than for 320 crop acres.

What causes these differences in per-unit costs? Variable costs (fuel, repairs, seed, etc.) per dollar of crop production for the (a) 2-plow, (b) 3-plow and (c) 2-plow, 3-plow machinery combinations differ only slightly. Fixed costs (taxes, depreciation and overhead) per dollar of crop production for the 2-plow *or* 3-plow combination are considerably larger than for the 2-plow, 3-plow combination. This is because fewer total units of output can be produced with the smaller equipment. Hence, the difference in cost per unit of production for the three machinery combinations is due mainly to differences in fixed costs (taxes, depreciation and overhead).

Low fixed costs per unit produced are obtained *only* by spreading the larger fixed costs of a 2-plow, 3-plow combination over more acres or units of output. Thus, a farmer with 80 to 160 crop acres can't reduce his per-unit costs merely by using a 2-plow, 3-plow machinery combination. A larger acreage and greater output are necessary for lower per-unit cost.

Hilly Farm . . .

The "hilly farm" has less cropland and more permanent pasture, forest and wasteland than the "average farm." Consequently, 120 acres of hilly land are required to obtain 40 acres of cropland as compared with 80 acres of the average farm for 40 acres of cropland. The rotation on the hilly farm also has

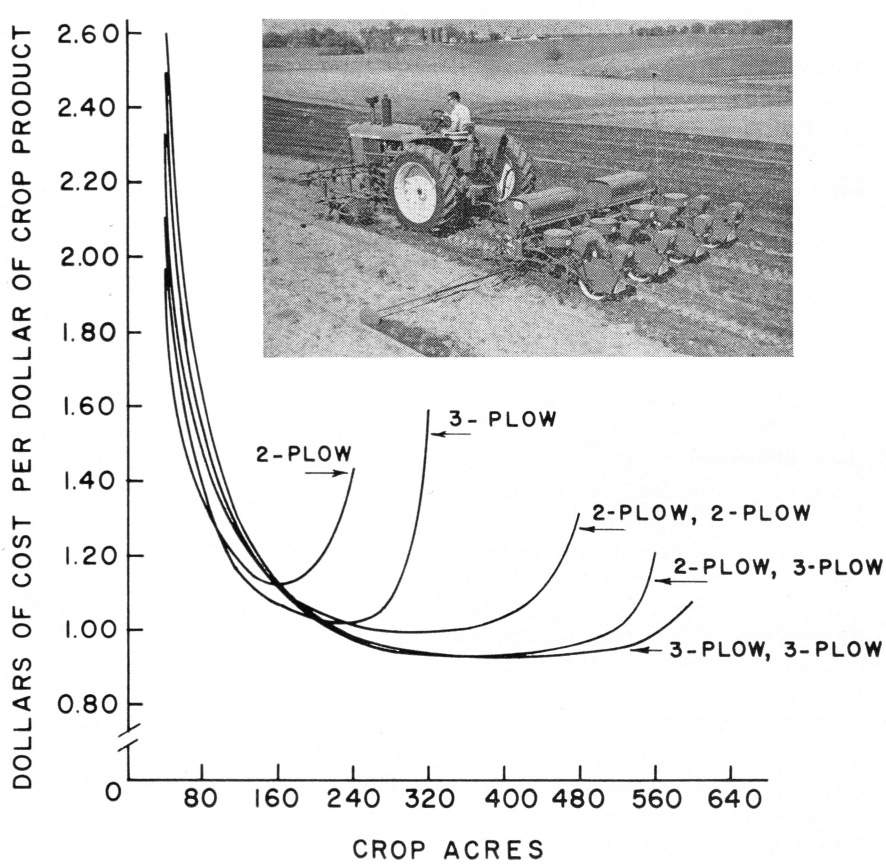

Chart 1. AVERAGE FARM. Average total cost per dollar of crop production by number of crop acres for different machinery combinations. Shelby-Grundy-Haig soils.

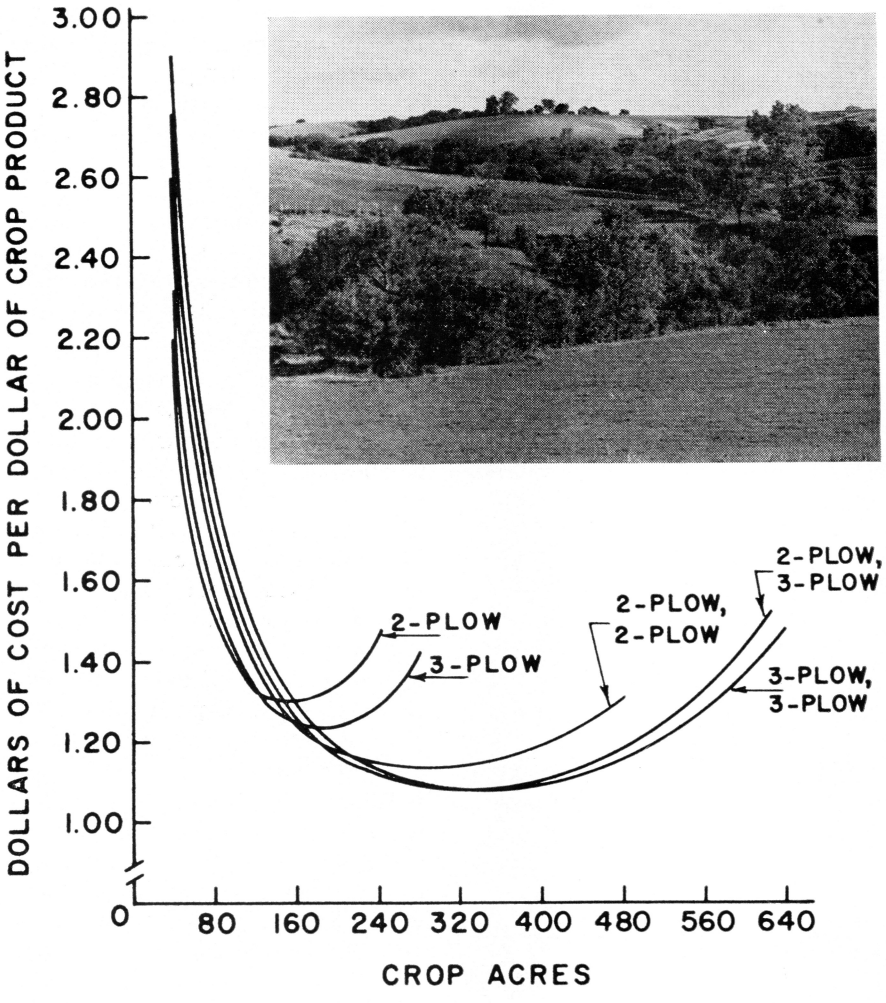

Chart 2. HILLY FARM. Average total cost per dollar of crop production by number of crop acres for different machinery combinations. Shelby-Grundy-Haig soils.

a lower proportion of row crops and a higher proportion of forage and small grain crops. As the rotation changes, the kinds of field operations that are untimely and cause yield losses also change. Untimely hay harvesting and corn cultivation cause the largest yield losses on the hilly farm. Untimeliness losses per acre are smaller on the hilly farm, however, than on the average farm, because yields on the hilly farm are generally lower.

Cost per unit of production: The costs for the five machinery combinations on the hilly farm are presented in chart 2. A one 2-plow or a one 3-plow combination is the most efficient machinery combination for small acreages. The two large machinery combinations — one 2-plow and one 3-plow or two 3-plows — are the most efficient for larger acreages. The two 2-plow combination remains relatively inefficient except for a narrow range in acreage, 140 to 160 crop acres, for a hilly farm of approximately 480 total acres.

Even though the one 2-plow combination, the one 3-plow combination and the two 2-plow combination are the most efficient for small acreages, they're relatively high cost combinations. These three combinations, together with the 2-plow, 3-plow combination, are the most efficient machinery combinations for 80, 120, 160 and 320 crop acres, respectively. However, the lowest cost per dollar of crop production for 80, 120 and 160 crop acres still is substantially larger than for 320 crop acres. Variable costs are about the same for all these acreages and the accompanying machinery combinations. Hence, the differences in total costs result from spreading the fixed costs over larger acreages and more units of output.

The shapes of the cost curves for hilly farms and average farms are quite similar. Per-unit cost is very high for small acreages. As acreage increases, per-unit cost declines, reaches a minimum and then rises again.

Cost per dollar of crop product on the hilly farm is larger than on the average farm for each acreage size. The higher cost is because of the lower productivity of the land which makes the land less profitable to operate as compared with land on the average farm. The lowest cost per dollar of production on the hilly farm is 15-20 percent higher than on the average farm. Differences in total sales per 40 crop acres cause some cost differences between the two farms. The hilly farm has lower yields and a smaller grain acreage than the average farm. Hence, with no untimeliness losses, total sales per 40 crop acres for the hilly farm are 10 percent less than for the average farm.

Again, these cost figures result when operating costs, value of labor, depreciation and interest on investment all are included. Hence, a farmer who has only a farm fitting the hilly farm definition wouldn't receive market value for his labor and capital. He'd still get some net income, but only by charging off less than the market wage on labor and investment. Thus, over time he'd receive low wages for his labor and slowly use up his stock of capital for consumption purposes.

Adding livestock production to crop production would increase net income. The livestock enterprise would lower the cost of producing each dollar's worth of farm commodity. Hence, net income would be increased. This is one of the reasons that farmers in southern Iowa are still able to maintain their farm enterprises in the face of higher costs and fairly constant incomes.

The results for the hilly farm — without considering custom operations — suggest that a two-man, two-tractor combination and 700 to 1,500 acres of land per farm are needed to gain most of the cost economies available in crop production from matching land to machine combinations. Even with this size, however, the relatively low productivity of the land makes it

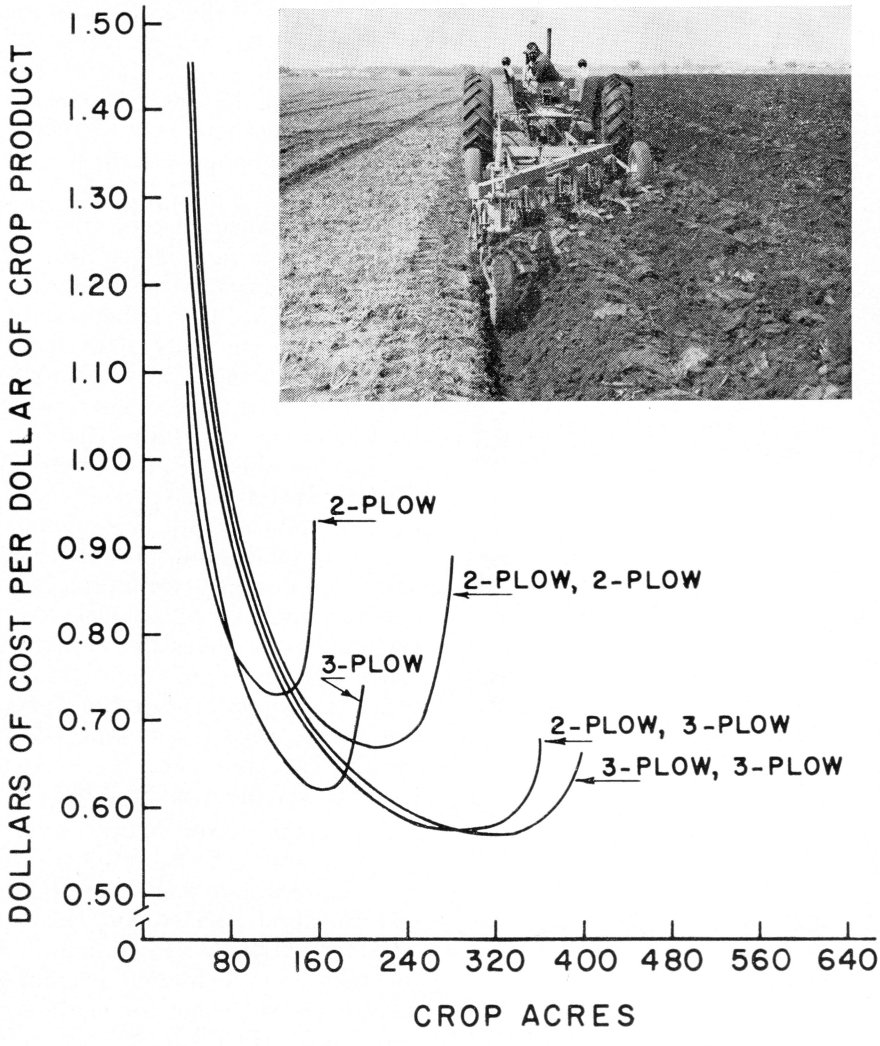

Chart 3. UPLAND FARM. Average total cost per dollar of crop product by number of crop acres for different machinery combinations. Shelby-Grundy-Haig soils.

difficult to produce at a profit with the current level of farm prices.

Upland Farm . . .

Total fixed machinery cost for the "upland farm" is less than for the average farm or hilly farm because different machinery combinations are used. There are no hay harvesting operations on the upland farm, since it supports a rotation consisting entirely of row crops. The upland soil mixture contains the highest proportion of cropland, 74 percent. Hence, less than 60 acres of the upland soil mixture are required to obtain 40 acres of cropland.

Cost per unit of production: The shape of the average cost curves for the upland farm (chart 3) differs slightly from the shape of the curves for the "average" farm (chart 1). The cost per dollar of crop production, however, is considerably lower on the upland farm than on the average farm. The acreage necessary to reach the lowest cost per unit of production for each machinery combination on the upland farm is also smaller than on the average farm. Total crop production cost per 40 cropland acres is smaller on the upland farm than on the average farm, but total crop revenue per 40 acres of cropland is larger on the upland farm. Hence, per-unit cost for each machinery combination and each acreage on the upland farm is lower than on the average farm.

The efficiency of combinations containing the 2-plow tractor declines on upland farms, and the efficiency of combinations including the 3-plow tractor increases. The 2-plow and 3-plow machinery combinations have the same capacity in hay harvesting operations, but the 2-plow combination has considerably less work capacity in row-crop operations. The 3-plow combination's superior capacity for row-crop operations accounts for its increased efficiency.

While the 2-plow and 3-plow combinations are the most efficient for small acreages, their per-unit costs remain relatively high. Thus, the minimum per-unit cost for 80 crop acres is 38 percent larger than for 320 crop acres. For 160 crop acres, per-unit costs still are 24 percent larger than for 320 crop acres.

Land classes for hilly, average and upland farms, Shelby-Grundy-Haig soil association area, south-central Iowa.

Land class	Hilly	Average	Upland
Cropland	33%	59%	74%
Permanent pasture	45	38	23
Forest or woodland	17	..	..
Gullies	2	..	..
Roads, farmstead, etc.	3	3	3

In Summary . . .

Our findings suggest that the machinery-land combination on many farms in southern Iowa still must be enlarged to attain the cost economies possible in crop production. It's unlikely, however, that all farms could attain the combination of land, labor and machinery that minimizes per-unit costs.

Total land in farms and total acres of cropland in the area have remained relatively stable in the past and are unlikely to increase in the future. Thus, an increase in acres of land and cropland per farm can be achieved only through additional consolidations of farms.

The cost analyses don't mean that all farms should be of the sizes noted. The analyses do show *how* crop costs are affected by different crop acreages and machine combinations and point up the cost-return pressures behind the adjustments going on in the area.